HandWritten Character Recognition

Akshit Mistry, Kunal Kotian, Ajinkya Ghorude
Computer Engineering, Universal College of Engineering, Mumbai, India.

Abstract – This paper represent a implementation of Optical Character Recognition (OCR) to translate images of typewritten or handwritten characters into electronically editable format and which is used mainly for printed character recognition and is insensitive to font style and size. OCR can do this by applying Scale Invariant Feature Transform algorithm (SIFT). The recognized characters are stored in editable format. Thus OCR checks the printed documents discarding noise.

Index Terms – Character recognition, Feature extraction, Scale Invariant Feature Transform (SIFT), Recognition of Output.

1. INTRODUCTION

Optical character recognition is a process of converting a printed document or scanned page into ASCII characters that a computer can recognize. Computer systems equipped with such an OCR system improve the speed of input operation and enable compact storage, fast retrieval and other file manipulations. The range of applications include postal code recognition, used in large administrative systems, banking, automatic cartography and reading devices for blind. Several algorithms for character recognition have been developed based on feature extraction**.** The performance of the systems have been constrained by the dependence on font, size and orientation. The recognition rate in these algorithms depends on the choice of features. Most of the existing algorithms involve rare processing on the image before the features are extracted that results is increased computational time. In this paper, we discuss a Scale Invariant Feature Transform (SIFT) based method for character recognition that would effectively reduce the image processing time while maintaining efficiency and versatility.

2. THE USE OF OCR SYSTEMS

OCR is the machine replication of human reading and has been the subject of intensive research. The principle motivation for the development of OCR systems is the increasing demand for conquer the printed documents or text. The application areas include:

1. Use by blind and deaf people.
2. Use in postal department.
3. Reading the address and post code to classify the different district mail.
4. Use in machine vision.
5. Use in library systems.
6. As a multi-purpose document reader for large scale data processing.
7. Use in bank and security service.
8. Use in business applications.
9. For reading product identification codes, goods declare forms and digital bar codes, etc

3. CONSTRUCTIONS OF OCR SYSTEM

The field of pattern recognition is a multidisciplinary field, which create the base of other fields, as for instance, Image Processing, Machine Vision, and Artificial Intelligence. Therefore, OCR cannot be applied without the help of Image Processing and/or Artificial Intelligence. In generally, a typical OCR system is composed by several parts. The main functional modules in our OCR systems are: Image acquisition module, pre-processing module, and feature extraction module and pattern generation. The main task of image acquisition module is to obtain text image from a scanner or a pre-stored image file. It is an "Image" because scanner inherently scans pixel of the text and not characters when patterns are scanned. The data may carry some unwanted noise. For example, a scanner with low resolution may produce touching line segments and smeared images. A pre-processor is used to smooth the scanned characters. Moreover, the system must be able to handle touching characters, corresponding spacing, line spacing and change of font style in the scanned text.

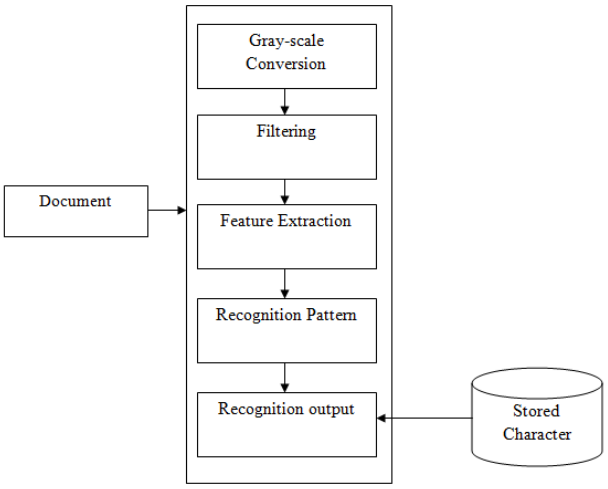

Figure 1. System Block Diagram

4. IMAGE PREPROCESSING

The function of this part is using a page scanner to transfer the original text image into a bitmap file or binary matrix. Different text analysing techniques are applied thereafter to differentiate the text image into lines and characters. The position of each character is recorded in the ASCII text file.

The system can be divided into three major parts, according to the dashed boxes in Figure.

They are:

(i) Gray scale image

(ii) Noise removal

(iii) Feature Extraction

1. Grayscale Conversion

In this proposed system image is captured through digital camera so the original image is colored image. For digital image processing it is necessary first colored image convert in to grayscale image. Each pixel has single sample image, which has intensity information. Now color image is converted into grayscale image with noise because there is some noise present in the input colored image due to some atmospheric conditions. This noise removal is therefore essential for the system. Grayscale images have many shades of gray. Grayscale images is result of measuring intensity of each pixel. For achieving accuracy the input image should be grayscaled. To convert a color space based image on an RGB color to a grayscale representation following function is used

$$Y = 0.2126R+0.7152G+0.0722B$$

Figure 2 and 3 shows an image before and after grayscaling.

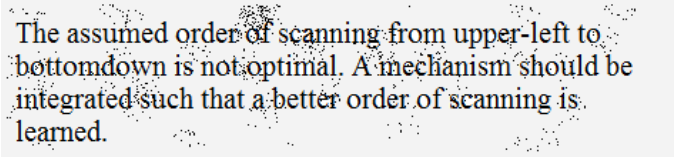

Figure 2. Before GrayScaling

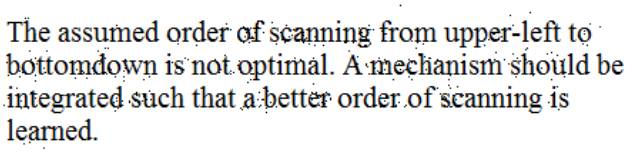

Figure 3. After GrayScaling

2. Noise Removal

The next step in image preprocessing is noise removal. It is necessary to remove the noise from the original image because it may produce difference between the actual image and captured image. This causes the variation in database feature and measured feature and also affects the accuracy of the system. Edge detection is difficult in noisy image. Noise and edges contain high- frequency content. Basically the noise produced in the image is due to device used for capturing image, atmosphere condition. In the proposed system the noise is removed by high-pass filter. Here high-pass filter can be used to make an image appear sharper. These filters emphasize fine details in the image. So before extracting features from the image, it is very important to remove the noise from the actual image.

In the example below, notice the minus signs for the adjacent pixels. If there is no change in intensity of pixels, nothing happens. But if one pixel is brighter than its immediate neighbors, it gets boosted.

0	-1/4	0
-1/4	+2	-1/4
0	-1/4	0

3. Feature Extraction

Feature extraction is the process of extracting information from input document about an object or a group of object in order to facilitate classification. The input document may contain n-number of lines of text that needs to be categorized into single character for recognition. For this proposal the following steps are:

1. The document is to be scanned for the initial darker pixel to be named as top-left of the row.

2. Now for bottom the next blank line is detected. The area between this row of characters is image.

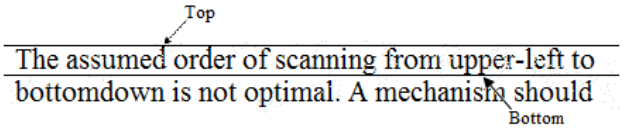

Figure 4. Row Detection

3. Now each character is to be identified from the row obtained earlier. This is done by scanning the row vertically from top to bottom, the first darker pixel detected is the leftmost pixel of character.

4. Now if all pixel are found to be blank then it is consider to be the right of character.

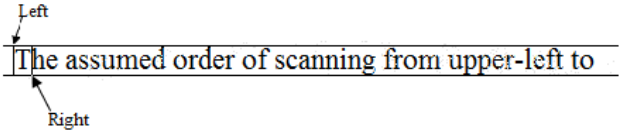

Figure 5. Boundary

5. The character from the scanned image is normalized from any pixel size to 15 x 15 pixel. It crops the image by using top, left, right, and bottom boundaries as in figure 6

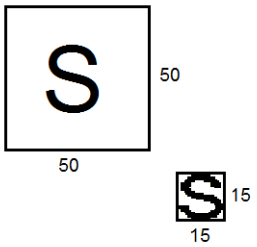

Figure 6. Scaling

6. Now the cropped image of 15 x 15 can be binarized into array of 15 x15, where black representing 1 and white representing 0 as shown in figure 7.

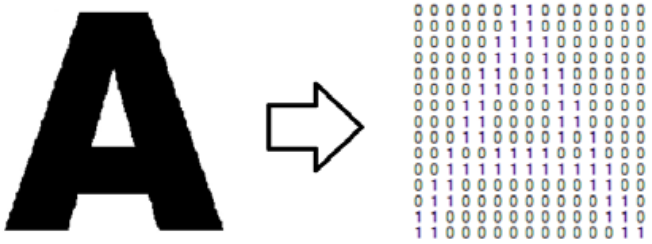

Figure 7 Binarization of character

5. RECOGNITION OF PATTERN

Pattern based recognition requires matching of generated binary format with the existing input of image. For this purpose the binary has been divided into 5 tracks. Further each track is subdivided into 8 sectors. A corresponding track-sector matrix is generated and it identifies number of pixels in each region.

This procedure is shown in figure 8.

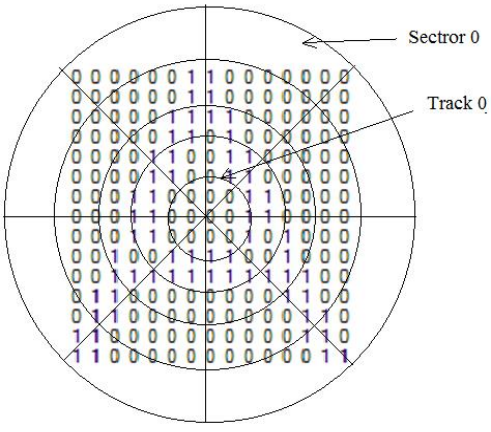

Figure 8 Division of tracks and sectors

This can be done using following steps:

1. Identify center of matrix

2. Calculate radius say rad by finding pixel with maximum distance from center using distance formulae.

Dist= $\sqrt{((y2-y1)^2+(x2-x1)^2)}$

3. Perform (rad ÷ 5) to identify size of each imaginary track.

4. Identify imaginary sectors.

5. Now develop track- sector matrix by calculating number of 1's in each intersection of sector and track.

6. RECOGNITION OF OUTPUT

It extracts input character features and compares these features with those recorded in the database used by the recognition. If the features are matched or closely matched, the input character is classified into a class within which all the characters have these common features. The track-sector matrix generated above is then matched with existing template. The existing template contain each track-sector intersection value, each track value and each sector value. If all these parameters are found to be match with the template values then the resultant character is identified. The resultant matrix contain unique value for each font and thus makes it easy to identify each font separately. A great many documents contains not only text lines, but also pictures, maps, forms, titles or headers, etc., while the recognition stage can only process individual characters. Therefore, the superfluous information other than character text should be removed.

7. IMPLEMENTED WORK

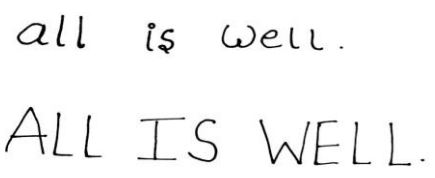

Fig. Captured Image

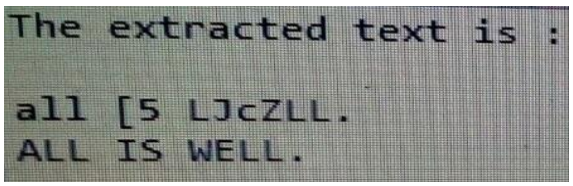

Fig. Extracted Output

8. CONCLUSION

We have shown that Scale Invariant Feature Transform can be implemented successfully in optical character recognition. The system has image pre and post processing modules for text

image. The experiment result shows recognition rate is 85%. Further work is initiated for multiple font and size characters and hand written character recognition. Developed for proposed algorithms cannot be applied to recognize a cursive handwriting Recognition.

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